Public Health and Safety

Affected Environment

Transmission facilities provide electricity for heating, lighting, and other services essential for public health and safety. These same facilities can potentially harm humans. Contact with transmission lines or any electrical line can kill or seriously injure people. Transmission structures and conductors can present an obstruction for aircraft. This section describes public health and safety concerns such as electrical shocks, fires, aircraft obstruction warnings, and electric and magnetic fields related to transmission facilities or construction activities.

The Federal Aviation Administration establishes requirements for towers and other tall structures that would potentially interfere with aircraft safety. Structures taller than 200 feet may require flashing warning lights for aircraft safety. BPA submits the final locations of structures and structure heights to FAA for their review and recommendations on airway marking and lighting (See Chapter 4 of this EIS).

Transmission lines, like all electric devices and equipment, produce ***electric and magnetic fields (EMF)***. Voltage, the force that drives the current, is the source of the electric field. Current, the flow of electric charge in a wire, produces the magnetic field. The strength of electric and magnetic fields depends on the design of the line and on distance from the line. Field strength decreases rapidly with distance.

Electric and magnetic fields are found around any electrical wiring, including household wiring and electrical appliances and equipment. Electric fields are measured in units of volts per meter (V/m) or kilovolts per meter (thousands of volts per meter, kV/m). Magnetic fields are measured in units of gauss (G) or milligauss (thousandths of a gauss).

Throughout a home, the electric field strength from wiring and appliances is typically less than 0.01 kV/m. However, fields of 0.1 kV/m and higher can be found very close to electrical appliances.

There are no national (United States) guidelines or standards for electric fields from transmission lines. . Washington has no electric-field limit. BPA designs new transmission lines to meet its electric-field guideline of 9-kV/m maximum on the right-of-way and 5-kV/m maximum at the edge of the right-of-way. The National Electric Safety Code (NESC) specifies that the maximum permissible induced shock current from large vehicles under transmission lines cannot exceed 5 milliamperes (mA). Because the induced current is directly inked to the electric field, this 5-mA criterion imposes a limit on electric fields where vehicles can be present under transmission lines.

Average magnetic field strength in most homes (away from electrical appliances and home wiring, etc.) is typically less than 2 ***mG***. Fields of tens or hundreds of milligauss are present

very close to appliances carrying high current. Typical magnetic field strengths for some common electrical appliances are given in Table 3-5. Unlike electric fields, magnetic fields from outside power lines are not reduced in strength by trees and building material. Transmission lines and distribution lines (the lines feeding a neighborhood or home) can be a major source of magnetic field exposure throughout a home located close to the line.

There are no national United States guidelines or standards for magnetic fields. The state of Washington does not have magnetic field limits. BPA does not have a guideline for magnetic field exposures. Guidelines for public and occupational magnetic-field exposures are well above environmental levels and above the levels found near transmission lines; they are based on short-term stimulation, not effects of long-term exposures.

Table 3-5: Typical Magnetic Field Strengths
(1 foot from common appliances)

Appliance	Magnetic Fields (mG)[1]
Coffee maker	1-1.5
Electric range	4-40
Hair dryer	0.1-70
Television	0.4-20
Vacuum cleaner	20-200
Electric blanket[2]	15-100

mG = milligauss
[1] The magnetic field from appliances usually decreases to less than 1 mG at 3 to 5 feet from appliances.
[2] Values are for distance from blanket in normal use (less than 1 foot away).
Source: Miler 1974; Gauger 1985

Environmental Consequences—Proposed and Alternative Actions

Potential health and safety impacts associated with the project include those that could affect construction workers, operation and maintenance personnel, crop dusters, other agricultural workers, the public, and others who have occasion to enter the project corridor.

Impact Levels

Impact levels are dependent on public and occupational use of the land. The potential for public health and safety impacts increases in areas where human activities take place.

A **high** impact would occur if the new line precludes the use of the right-of-way for pre-existing activities.

A **moderate** impact would occur if the new line alters pre-existing right-of-way activities.

A **low** impact would occur if the new line would not produce a change in ROW activities.

Impacts During Construction

During construction and installation of the towers and conductor/ground wires, there is a risk of fire and injury associated with the use of heavy equipment, hazardous materials such as fuels, cranes, helicopters, potential bedrock blasting for towers or access roads, and other risks associated with working near high-voltage lines. There is also a potential for fire during refueling of hot equipment such as trackhoes and bulldozers that cannot be taken off-site for refueling. Connection of conductors may be accomplished using implosion fittings, which could be a source of injury to construction personnel. In addition, there are potential safety issues with more traffic on the highways and roads in the project area during construction.

Impacts During Operation and Maintenance

Electrical Safety. Power lines, like electrical wiring, can cause serious electric shocks if certain precautions are not taken. These precautions include building the lines to minimize shock hazard. All BPA lines are designed and constructed in accordance with the National Electrical Safety Code (NESC) and BPA practices. The NESC specifies the minimum allowable distance between the lines and the ground or other objects. These requirements determine the height of the line, and the edge of the right of way; i.e., the closest point that houses, other buildings, and vehicles are allowed to the line.

People must take precautions when working or playing near power lines. It is extremely important that a person not bring anything, such as a TV antenna, irrigation pipe, or water streams from an irrigation sprinkler too close to the lines. BPA provides a free booklet that describes safety precautions for people who live or work near transmission lines (see Appendix D, Living and Working Safely Around High Voltage Power Lines).

Electric and Magnetic Fields. Possible effects associated with the interaction of electric and magnetic fields from transmission lines with people on and near a right-of-way fall into two categories:

- short-term effects that can be perceived and may represent a nuisance, and
- possible long-term health effects.

Short-term effects and the levels of electric and magnetic fields near the proposed transmission lines are discussed below and in detail in Appendix B-1, *Electrical Effects*. A review of recent studies and their implications for health-related effects is provided in a separate technical report, Appendix B-2, *Assessment of Research Regarding EMF and Health and Environmental Effects*. In addition, the Department of Energy provides a booklet on this topic (Questions and Answers about EMF published in 1995).

The issue of whether there are long-term health effects associated with exposure to fields from transmission lines and other sources has been investigated for several decades. There is little evidence that electric fields cause long-term health effects. Estimates of magnetic-field exposures have been associated with certain health effects in studies of residential and occupational populations. Research in this area is continuing to determine whether such associations might reflect a causal relationship.

Scientific reviews of the research on EMF and health have stated that there is insufficient evidence to conclude that EMF exposures lead to long-term health effects, such as adult cancer, or adverse effects on reproduction, pregnancy, or growth and development of the embryo. Based on epidemiology studies, some uncertainty remains about the possible effect of magnetic-field exposure above 4 mG on the risk of childhood leukemia. However, as the scientific reviews also indicate, animal or cellular studies provide little support for the idea that the statistical associations reflect a causal relationship, i.e., that magnetic-field exposure increases the risk of childhood or adult cancer. Furthermore, national and international organizations have established public and occupational EMF exposure guidelines on the basis of short-term stimulation effects, rather than long-term health effects. In so doing, these organizations did not find data sufficient to justify the setting of a standard to restrict long-term exposures to electric or magnetic fields.

Short-term Effects – Electric Fields. Electric fields from high-voltage transmission lines can cause nuisance shocks when a grounded person touches an ungrounded object under a line or when an ungrounded person touches a grounded object. Transmission lines are designed so that the electric field will be below levels where primary shocks could occur from even the largest (ungrounded) vehicles expected under the line. Fences and other metal structures on and near the right-of-way would be grounded during construction to limit the potential for nuisance shocks. Questions about grounding or reports of nuisance shock received under a line should be directed to BPA. Electric fields from the proposed line would not exceed the BPA electric-field guidelines of 9 kV/m on the right-of-way and 5 kV/m at the edge of the right-of-way.

Short-term Effects - Magnetic Fields. Magnetic fields from transmission lines can induce currents and voltages on long conducting objects parallel to the lines. These voltages can also serve as a source of nuisance shocks. However, the effects are well understood and can be mitigated by grounding and other measures. Magnetic fields from transmission lines (and other sources) can distort the image on computer monitors. The threshold for interference depends on the type and size of monitor. Historically, this phenomenon is reported at magnetic-field levels at or above 10 mG, but some more sensitive monitors may exhibit image distortion at lower levels. Interference from transmission line magnetic fields is generally not a problem at distances greater than 200 to 250 feet from a line.

Locations of Line Configurations Evaluated. For this project there are ten line configurations consisting of different transmission lines and of varying lengths along the corridor. The Agency

Proposed Action would involve Configurations 1,2, 3, 4, 6, 8, and 10. The locations are described in that order for the reader.

- **Configuration 1**: About 2 miles of the right-of-way are represented in Configuration 1 (see Figure 3-5). This configuration would be located where the proposed line parallels the existing Grand Coulee-Hanford 500 kV line just south of the Grand Coulee substation (corridor mile 0/0 to 3/1). This segment of line passes west of the City of Grand Coulee and east of Delano Heights.

- **Configuration 2**: One mile of the right-of-way is represented in Configuration 2 (see Figure 3-6). This configuration would be located where the proposed line leaves the Grand Coulee-Hanford corridor and crosses the plateau south of the City of Grand Coulee to meet the Grand Coulee-Bell corridor (corridor mile 3/1 to 3/8). There are very few residences or buildings, if any, adjacent to the right-of-way in this area.

- **Configuration 3**: About 75 miles of the right-of-way are represented in Configuration 3 (see Figure 3-7). This configuration would be located from the plateau south of the City of Grand Coulee to a point about 600 feet west of Indian Trail Road in Spokane, Washington (corridor mile 3/8 to 78/6). This segment of line is sparsely populated. For this configuration, the proposed single-circuit line would be entirely within the existing Grand Coulee-Bell right-of-way.

- **Configuration 4**: About one-third of a mile of the right-of-way would be represented in Configuration 4 (see Figure 3-8). This configuration would replace a portion of Configuration 3 in the cliff area adjacent to Coulee-Hite Road just west of Springhill substation (corridor mile 73/1 to 73/4). This segment of line is sparsely populated. This configuration is a proposed double-circuit line that would be entirely within the existing Grand Coulee-Bell right-of-way.

- **Configuration 6**: About 3 miles of the right-of-way would be represented in Configuration 6 (see Figure 3-9). This configuration would be located from a point 600 feet west of Indian Trail Road to about 0.5 mile west of Waikiki Road (corridor mile 78/6 to 81/7). This segment of line passes through residential areas of Spokane and Spokane County. For this configuration, the proposed single-circuit line would be entirely within the existing Grand Coulee-Bell right-of-way.

- **Configuration 8**: About 1.5 miles of the right-of-way would be represented in Configuration 8 (see Figure 3-10). This configuration would be located from 0.5 mile west of Waikiki Road to about one-quarter mile east of Highway 395 (corridor mile 81/7 to 83/1). This segment of line passes through residential areas in Spokane County and north of Whitworth College. For this configuration, the proposed single-circuit line would be entirely within the existing Grand Coulee-Bell right-of-way.

- **Configuration 10**: About 0.6 miles of the right-of-way would be represented in Configuration 10 (see Figure 3-11). This configuration would be located from one-quarter mile east of Highway 395 to one-quarter mile east of Highway 2 (corridor mile 81/7 to 83/6). This segment of line passes through residential areas and a commercial area, including the Hico Village Northpointe facility. For this configuration, the proposed double-circuit line would be entirely within the existing Grand Coulee-Bell right-of-way.

Configurations 5, 7 and 9 address the double-circuit alternative of the Alternative Action and are described below.

- **Configuration 5**: About 3.5 miles of the right-of-way would be represented in Configuration 5 (see Figure 3-12). This configuration would be a double-circuit alternative at the eastern end of configuration 3 from a point about one-quarter mile west of Riverside State Park to a point about 600 feet west of Indian Trail Road in Spokane, Washington (corridor mile 75/2 to 78/6). This segment of line is sparsely populated. For this configuration, the proposed double-circuit line would be entirely within the existing Grand Coulee-Bell right-of-way.

- **Configuration 7**: Configuration 7 (see Figure 3-13) would be a double-circuit alternative to Configuration 6 (corridor mile 78/6 to 81/7). This configuration would be located from a point 600 feet west of Indian Trail Road to about 0.5 mile west of Waikiki Road (corridor mile 78/6 to 81/7). This segment of line passes through residential areas of Spokane and Spokane County.

- **Configuration 9**: Configuration 9 (see Figure 3-14) would be a double-circuit alternative to Configuration 8 (corridor mile 81/7 to 83/1). This configuration would be located from 0.5 mile west of Waikiki Road to about one-quarter mile east of Highway 395 (corridor mile 81/7 to 83/1). This segment of line passes through residential areas in Spokane County and north of Whitworth College.

Electric and Magnetic Field Levels. An increase in public exposure to electric and magnetic fields could occur if field levels increase and if residences or other structures attract people to these areas. The predicted field levels are only indicators of how the proposed project may affect the magnetic-field environment. They are not measures of risk or impacts on health. The 84-mile-long corridor in which the proposed line would be built is sparsely populated along most of its length, except for the easternmost seven miles, which passes through residential and other more densely populated areas.

BPA has predicted the annual peak electric and magnetic fields from the proposed and existing transmission lines along the corridor. (Appendix B-1 contains this information). This allows a comparison between the fields with the proposed line and the fields from existing lines without the proposed line (the no-action alternative) in the various areas. The field levels from the

existing and proposed lines change along the corridor, depending on how many lines are in the corridor, where they are located relative to one another, and the width of the right-of-way. The predicted levels for electric and magnetic fields are maximum levels that would occur under maximum voltage conditions for electric fields and annual peak current conditions for magnetic fields. Magnetic fields averaged over a year would be one-half or less than the estimated maximum values reported in Appendix B-1 and summarized in the sections below.

In Configurations 1 and 2 for about three miles immediately south of the Grand Coulee Substation, the proposed line would be on new right-of-way and adjacent to the edge of the right-of-way. For these configurations the changes in electric fields at the edges of the righ-of-way associated with the proposed line versus the existing line (Configuration 1) or no line (Configuration 2), range from no change to an increase of 2.5 kV/m.

Changes in magnetic fields at the edges of the right-of-way for Configurations 1 and 2 would range from a decrease of 14 mG to an increase of 83 mG. Plots of the maximum magnetic field versus distance from the line for the proposed and no-action alternatives are shown in Figure 3-5 for Configuration 1 and in Figure 3-6 for Configuration 2.

The changes in electric and magnetic fields for Configurations 1 and 2 of the proposed action would not affect land use in the area. However, the physical presence of a second 500-kV line in the populated area near the City of Grand Coulee (Configuration 1) could impact the use of recreational areas. The Public Health and Safety impacts for Configurations 1 and 2 are therefore Low/Moderate and Low, respectively.

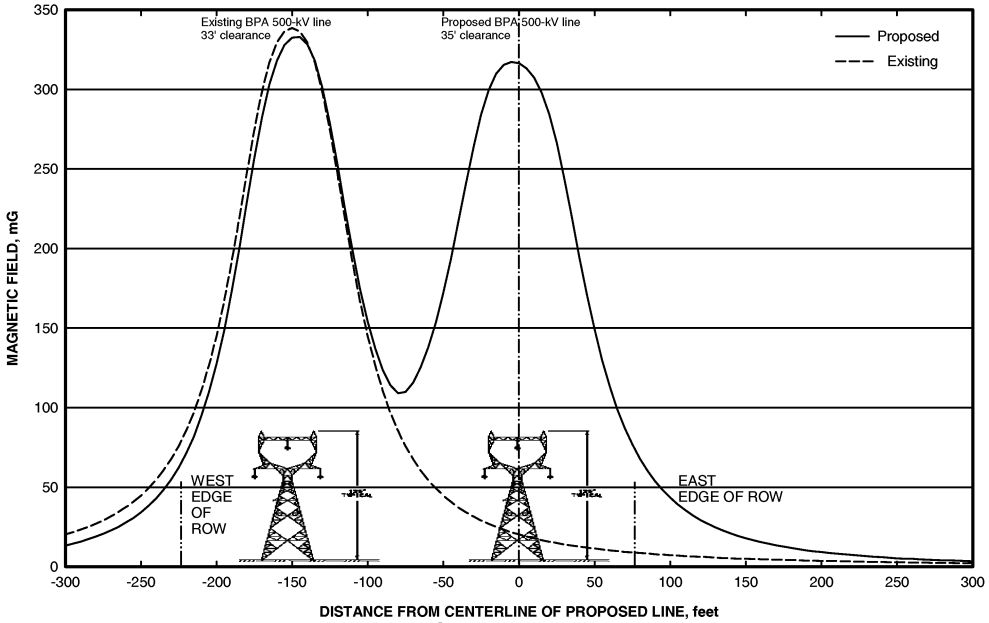

Figure 3-5 Right-of-Way Configuration 1

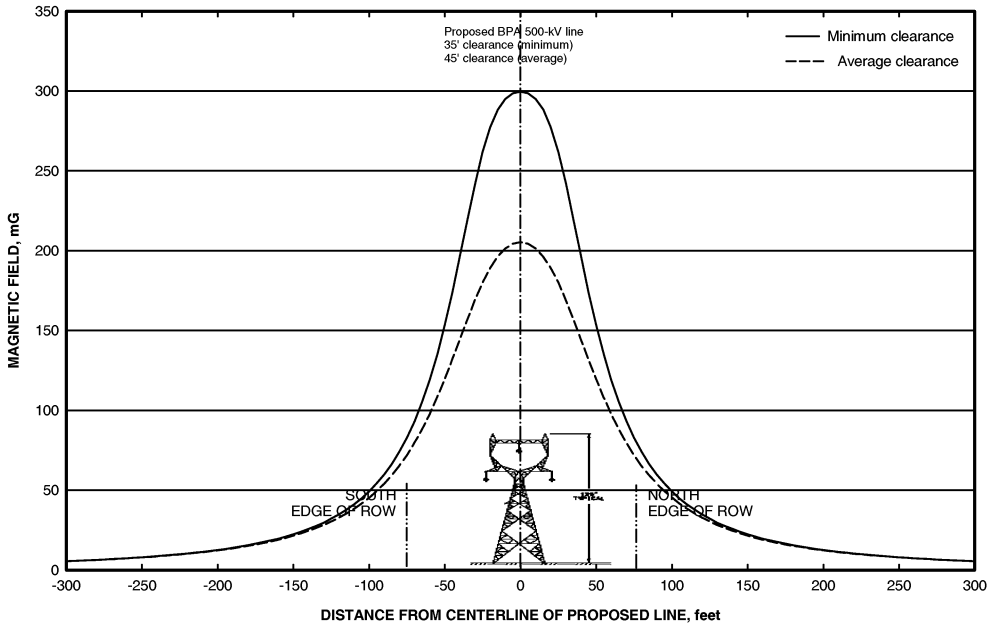

Figure 3-6 Right-of-Way Configuration 2

In Configurations 3 through 10, the remaining 81 miles of the proposed line would be located on the existing right-of-way of the Grand Coulee – Bell corridor and would not be adjacent to the edge of that right-of-way. In Configurations 3, 6, and 8 the proposed line would be on single-circuit structures, while in Configurations 4, 5, 7, 9, and 10 the proposed line would be on double-circuit structures.

The proposed action is to link Configurations 3, 4, 6, 8, and 10 over the length of the Grand Coulee – Bell corridor. In this action, double-circuit structures would be used only in the short sections near the escarpment west of the Springhill Substation (Configuration 4 - 0.68 miles) and across the commercial area leading into the Bell Substation (Configuration 10 - 0.6 miles). In the alternative action, double-circuit configurations would replace a portion of single-circuit Configuration 3, and all of Configurations 6 and 8.

For Configurations 3 through 10, the addition of the proposed line would reduce or not change the electric field at the edge of the right-of-way of the Grand Coulee – Bell corridor compared to the electric field from the existing lines. However, for these configurations, the peak electric fields on the right-of-way would increase from the levels associated with 115-kV lines (1.4 kV/m) and 230-kV lines (2.9 – 3.4 kV/m) to those associated with the proposed 500-kV line (7.4 – 8.9 kV/m).

For Configurations 3 through 10, the addition of the proposed line would reduce or not change the magnetic field at the edge of the right-of-way with three exceptions. There would be a maximum increase of 9 mG at the south edge of the right-of-way in Configuration 4 (0.68 miles),

a maximum increase of 5 mG at the north edge of the right-of-way in Configuration 10, and a maximum increase of 1 mG at the south edge of the right-of-way in Configuration 10. For these configurations, peak magnetic fields on the ROW would increase or decrease depending on the configuration. Peak fields for the proposed action single-circuit configurations tend to be higher than those for the no-action alternative, while peak fields for the alternative action double-circuit configurations are lower than those for the no action alternative. Plots of magnetic field versus distance from the line for the configurations in the proposed action are shown in Figures 3-7 to 3-11. Magnetic fields from the alternative action configurations with double-circuit structures (Configurations 5, 7, and 9) are shown in Figures 3-12 to 3-14.

For Configurations 3 through 9, the proposed and alternative actions would replace an existing line in a multiple-line corridor. Electric and magnetic field changes would essentially occur only on the right-of-way where exposures are transitory. In many instances the proposed action would reduce electric and magnetic field levels at the edge of the right-of-way and beyond. Therefore, the changes in electric and magnetic fields in Configurations 3 through 9 will not affect land use on or adjacent to the right-of-way. The Public Health and Safety impacts for these configurations are therefore Low.

In Configuration 10, there is considerable activity involving large vehicles and storage of vehicles on the right-of-way. Therefore the addition of a 500-kV line with higher electric fields will substantially impact the use of this commercial area. The changes in electric fields off the ROW and the changes in magnetic fields on and off the right-of-way will not affect land use in Configuration 10. The Public Health and Safety impacts for Configuration 10 are Moderate/High.

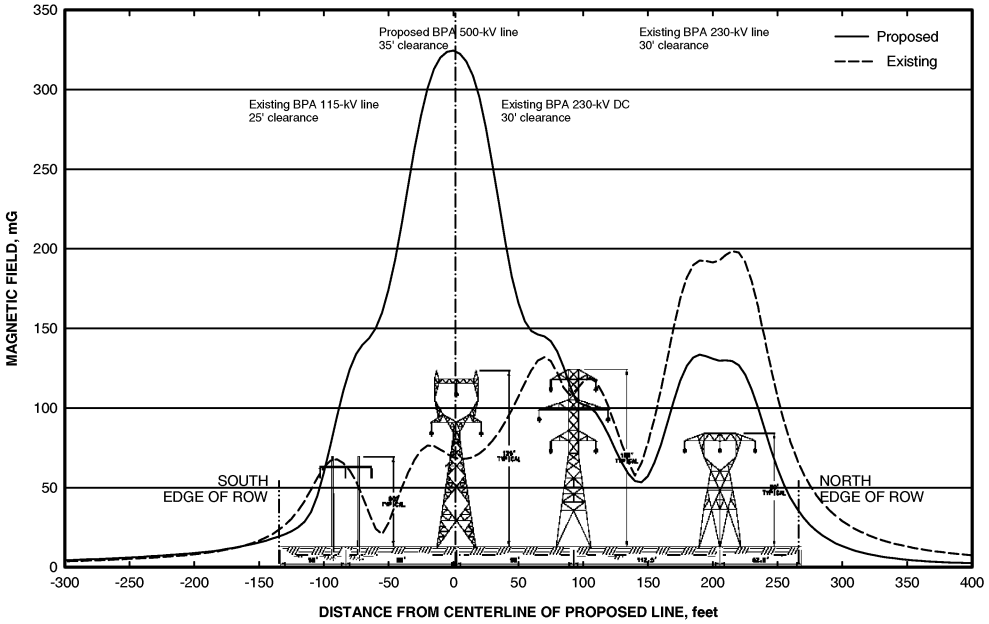

Figure 3-7 Right-of-Way Configuration 3

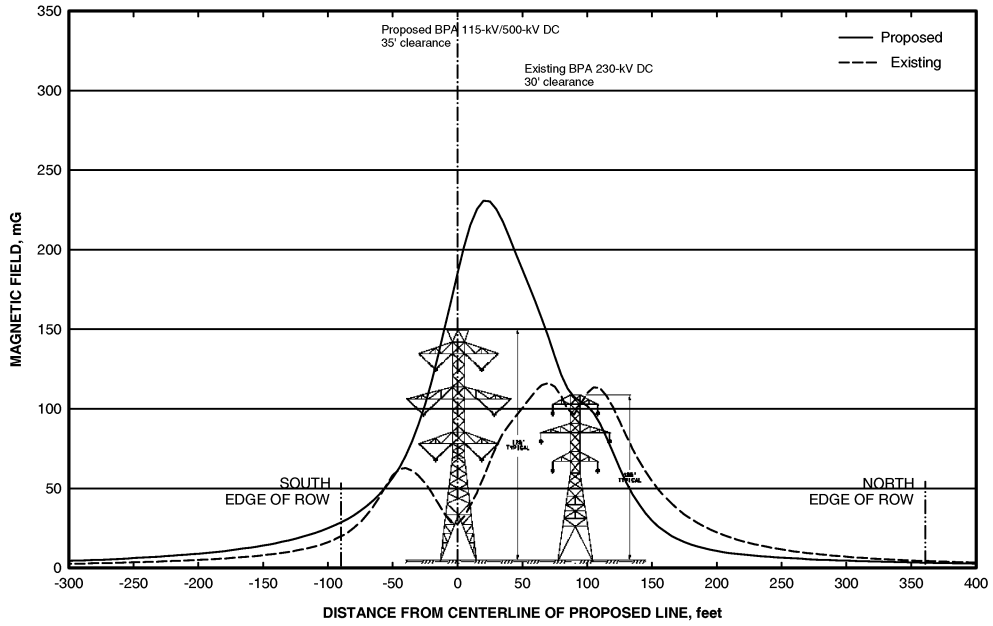

Figure 3-8 Right-of-Way Configuration 4

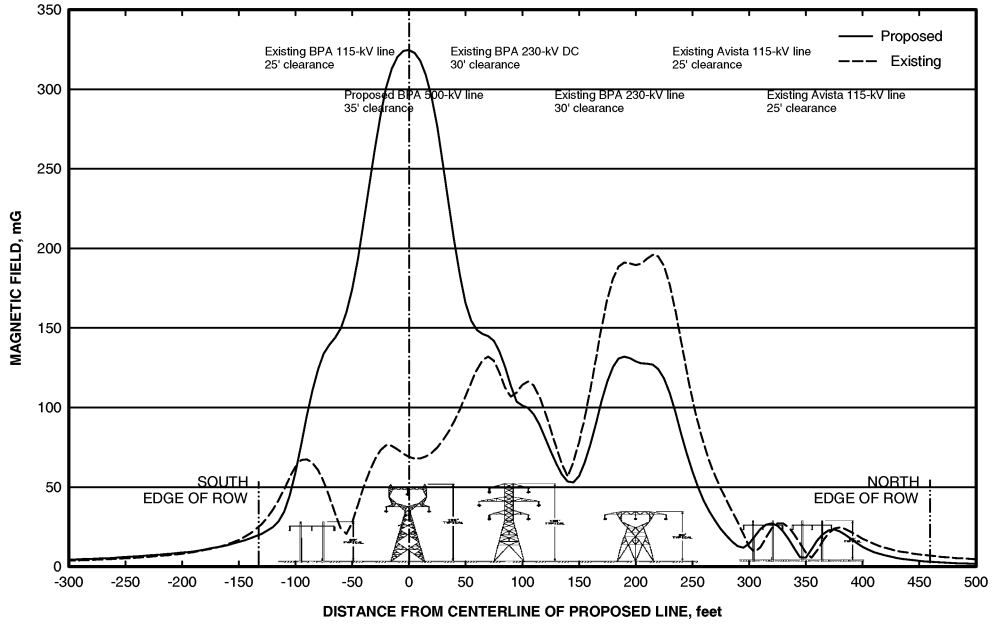

Figure 3-9 Right-of-Way Configuration 6

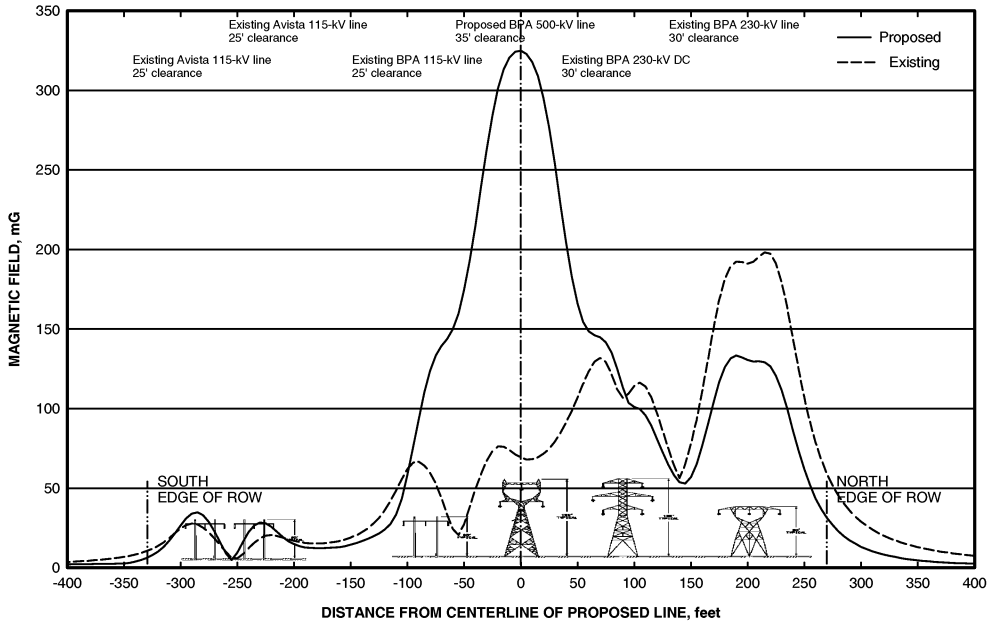

Figure 3-10 Right-of-Way Configuration 8

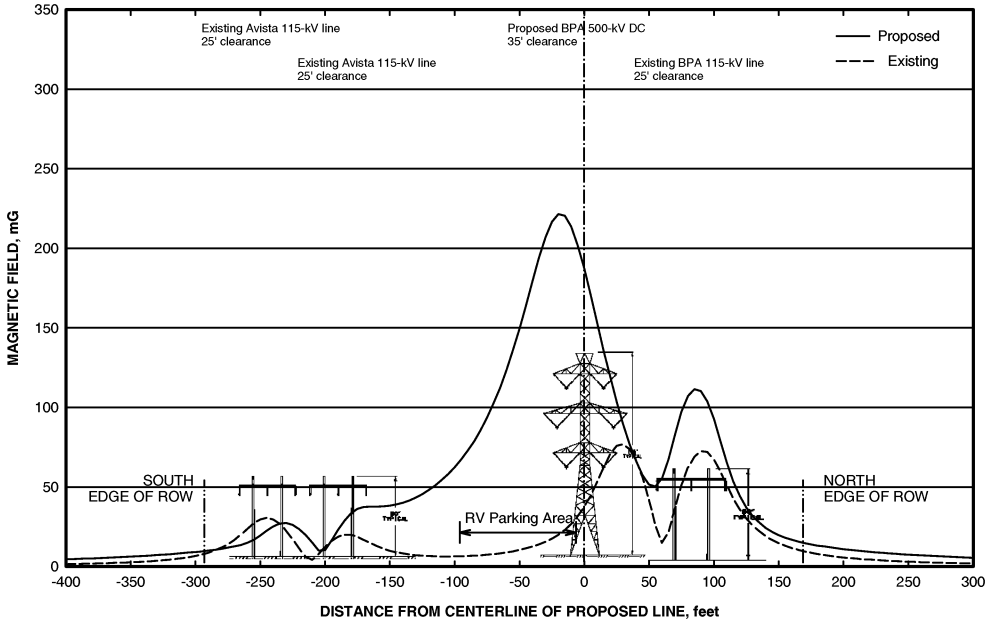

Figure 3-11 Right-of-Way Configuration 10

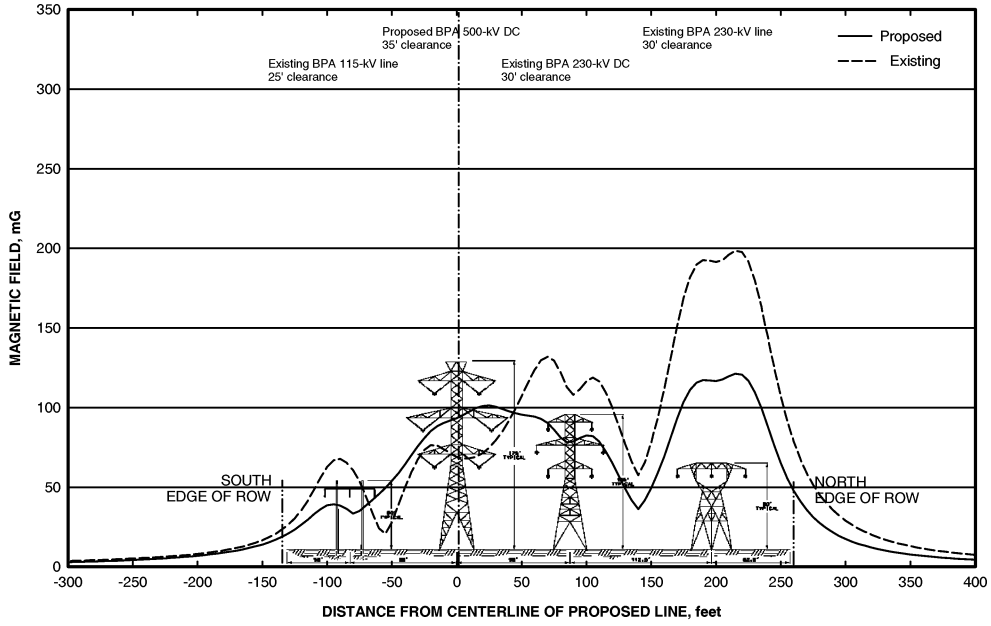

Figure 3-12 Right-of-Way Configuration 5

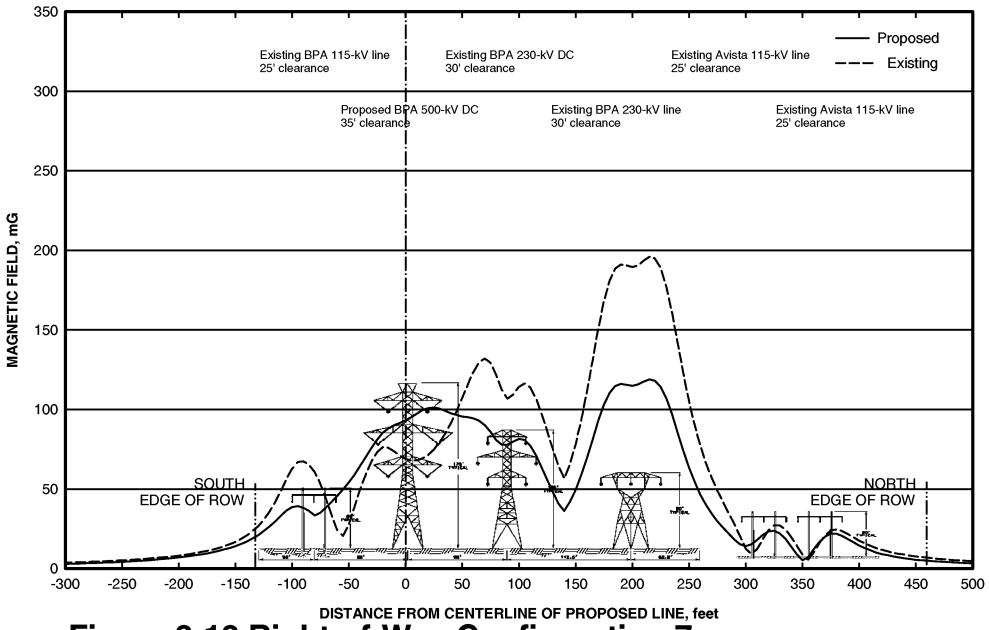

Figure 3-13 Right-of-Way Configuration 7

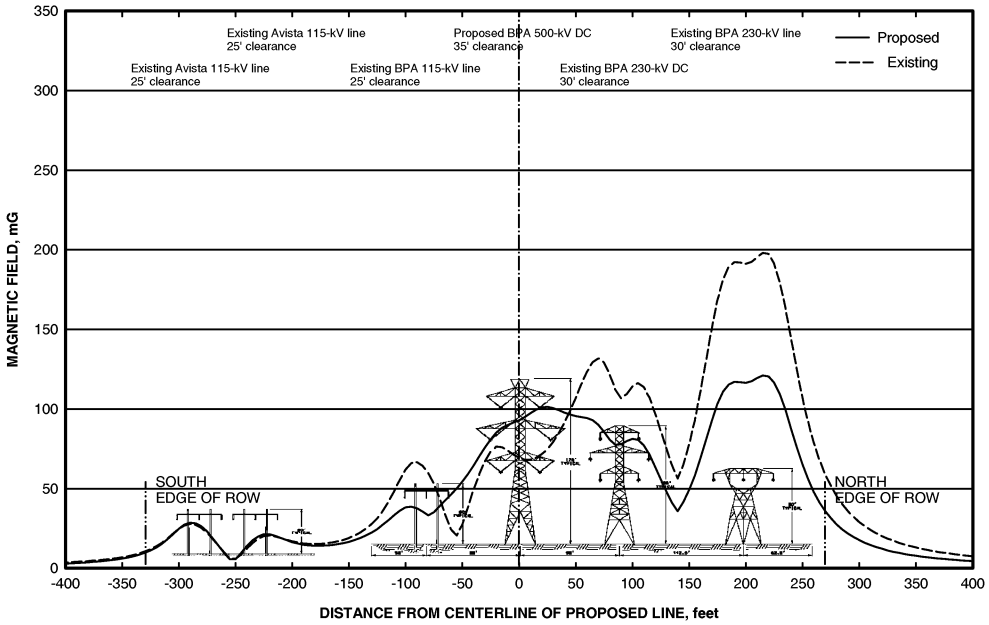

Figure 3-14 Right-of-Way Configuration 9

Environmental Consequences of the Alternative Action

Summary

The public health and safety impacts for the proposed action, the alternative action and no action are summarized in the chart below.

Action	Configuration									
	1	2	3	4	5	6	7	8	9	10
Proposed	L/M	L	L	L	N/A	L	N/A	L	N/A	M/H
Alternative	L/M	L	L	L	L	N/A	L	N/A	L	M/H
No Action	N/A	N/A	L	L	L	L	L	L	L	L

L = Low, M= Moderate, H = High, N/A = Not applicable

In summary, the overall impacts from this project related to public health and safety would be low. Impacts are increased in a few areas where intensive use of the right-of-way occurs and the proposed 500-kV line could impact activities either because of safety concerns or nuisance shocks related to electric fields. In populated areas, changes to electric- and magnetic-field exposures at residences along the corridor will be minimal or decreased.

Toxic and Hazardous Substances

There are no known occurrences of hazardous materials or contaminants within the transmission line corridor. However, if a hazardous material, toxic substance, or petroleum product is discovered that could pose an immediate threat to human health or the environment, BPA requires that the contractor notify the Contracting Officer's Technical Representative (COTR) immediately. Other conditions such as large dump sites, drums of unknown substances, suspicious odors, stained soil, etc. shall also be reported immediately to the COTR. The COTR would coordinate with the appropriate personnel within BPA. In addition, the contractor would not be allowed to disturb such conditions until the COTR has given the notice to proceed.

Cumulative Impacts

The proposed project would contribute a small increase in the overall risk of fire and injury to the public that could occur during construction and operation/maintenance. The incidence of nuisance shocks could occur infrequently under the proposed line.

Mitigation

The following mitigating measures would help minimize potential health and safety risks.

- Prior to starting construction, contractor would prepare and maintain a safety plan in compliance with Washington requirements. This plan would be kept on-site and would detail how to manage hazardous materials such as fuel, and how to respond to emergency situations.

- During construction, the contractors would also hold crew safety meetings at the start of each workday to go over potential safety issues and concerns.

- At the end of each workday, the contractor and subcontractors will secure the site to protect equipment and the general public.

- Employees would be trained, as necessary, in tower climbing, cardiopulmonary resuscitation, first aid, rescue techniques, and safety equipment inspection.

- To minimize the risk of fire, fuel all highway-authorized vehicles off-site. Fueling of construction equipment that was transported to the site via truck and is not highway authorized would be done in accordance with regulated construction practices and state and local laws. Helicopters would be fueled and housed at local airfields or at staging areas.

- Helicopter pilots and contractor take into account public safety during flights. For example, flight paths could be established for transport of project components in order to avoid flying over populated areas or near schools (Helicopter Association 1993).

- Provide notice to public of construction activities, including blasting.

- Take appropriate safety measures for blasting consistent with state and local codes and regulations. Remove all explosives from the work site at the end of the workday.

- If implosion fittings are used to connect the conductors, install in such a way as to minimize potential health and safety risks to workers?.

- Operation and maintenance vehicles would carry fire suppression equipment including (but not limited to) shovels and fire extinguishers.

- Stay on established access roads during routine operation and maintenance activities.

- Keep vegetation cleared according to BPA standards to avoid contact with transmission lines.

- Submit final tower locations and heights to the Federal Aviation Administration for review and potential marking and lighting requirements.

- Construct and operate the new transmission line to meet the National Electrical Safety Code, as required by law.

- During construction, follow BPA specifications for grounding fences and other objects on and near the proposed right-of-way.

Environmental Consequences of the No Action Alternative

Potential health and safety risks associated with the ongoing operations and maintenance activities for the existing transmission line, substations, right-of-way, and accesses roads would continue. No new public health and safety impacts would be expected.

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